



Measuring levels, assessing determinants and variabilities of nanoparticle concentrations in residential environment, the NANOP project

Xiaolin Ji, Corinne Mandin, Olivier Ramalho, Olivier Le Bihan, Laurent Martinon, Jean-Claude Pairon, Denis Bard

► To cite this version:

Xiaolin Ji, Corinne Mandin, Olivier Ramalho, Olivier Le Bihan, Laurent Martinon, et al.. Measuring levels, assessing determinants and variabilities of nanoparticle concentrations in residential environment, the NANOP project. Indoor Air 2008. The 11th International Conference on Indoor Air Quality and Climate., Aug 2008, Copenhagen, Denmark. pp.192. hal-00701715

HAL Id: hal-00701715

<https://hal.science/hal-00701715>

Submitted on 25 May 2012

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Measuring levels, assessing determinants and variabilities of nanoparticle concentrations in residential environment, The NANOP Project

Xiaolin Ji^{1,2}, Corinne Mandin^{1,*}, Olivier Ramalho³, Olivier Le Bihan¹, Jean-Claude Pairon², Laurent Martinon⁴ and Denis Bard⁵

¹National Institute for Industrial Environment and Risks (INERIS), France

²Paris XII University / INSERM Unit 841, France

³Scientific and Technical Centre for Building (CSTB), France

⁴Inhaled Particle Laboratory (LEPI), France

⁵School of Advanced Studies in Public Health (EHESP), France

*Corresponding email: Corinne.Mandin@ineris.fr

Keywords: Nanoparticles, Ultrafine particles, Indoor sources, Exposure

Introduction

Non engineered nanoparticles (NP), also called ultrafine particles ($\varnothing < 100$ nm), have numerous sources in the atmosphere as well as indoors (e.g. traffic, cooking...). To date studies on NP levels in ambient and indoor air are scarce. The NANOP project aims at assessing nanoparticle levels and their spatial and temporal variation in a domestic environment. The study is carried out in an experimental and fully controlled house.

Materials and Methods

First a ranking of domestic sources was performed, based on NP emission factors from a scientific literature review or previously assessed by the French Scientific and technical centre for building (CSTB) in experimental test chambers. Sources prevalence in dwellings, frequency and duration of use and possible particle toxicity were also taken into account. Cooking, toasting, burning scented candles or incense, spraying air freshener, using hair spray, smoking, and vacuuming were operated independently as in real life conditions, in June 2007. While cooking, influence of air exhaust fan in the kitchen and mechanical ventilation was studied. A typical daily activity pattern was elaborated and reproduced 4 times in order to simulate real life and assess multiple source exposure. Particulate matter (PM_{2.5}) analysers, condensation particle counters (CPC), scanning mobility particle sizer (SMPS), optical particle counters (OPC) and specific surface analyser (AeroTrack 9000®) were run in the kitchen, the living-room, the bathroom all on the same floor, the bedroom upstairs, and outdoor.

Results

Table 1. Maximum concentration (particle/cm³, 1 minute mean) measured with CPCs while cooking 2 steaks in the kitchen (gas stove).

	Kitchen down-stairs [27 m ³] †	Bathroom down-stairs [5 m ³] #	Bedroom up-stairs [29 m ³] #
1	1,101,000	85,700 (27')	165,000 (10')
2	537,667	52,000 (25')	115,700 (7')
3	764,667	-	163,200 (11')

1: without exhaust hood, mechanical ventilation at low level (50 m³/h in the kitchen)

2: with exhaust hood, mechanical ventilation at low level

3: without exhaust hood, mechanical ventilation at high level (110 m³/h in the kitchen)

in brackets: time after peak in kitchen (minutes)

†: water CPC 3785, in photometric mode

#: CPC 3007, corrected for coincidence effect

Table 2. Maximum concentration (particle/cm³, 1 minute mean) measured with CPCs while operating different sources.

	Living-room, near the source †	Bedroom upstairs #
Air freshener (3 s)	30,660	-
Smoking one cigarette	71,900	19,000
Burning incense (15')	334,667	12,500
Burning candle (15')	52,650	10,600
Hair drying (5')	14,467	11,300
Vacuum cleaning (6')	16,025	11,300

Discussion

First results show high NP concentrations close to the sources, non negligible NP concentrations in adjacent and distant rooms, and a positive effect of exhaust fan and mechanical ventilation.